

## Claims

1. A group judgment device that is connected to a network, comprising:

5 a target time obtaining unit operable to obtain, as a target time, a time required by data with a predetermined format to travel to and/or from a target device connected to the network; and

a judgment unit operable to compare the target time with a reference time, the reference time being a time required  
10 by data with the predetermined format to travel to and/or from a device belonging to a predetermined group, and judge that the target device belongs to the group when a difference between the target time and the reference time is within a predetermined range, and judge that the target device is  
15 external to the group when the difference is not within the predetermined range.

2. The group judgment device of Claim 1, further comprising

20 a judgment request receiving unit operable to receive, from the target device, a request to judge whether the target device belongs to the group,

wherein the target time obtaining unit obtains the target time when the judgment request receiving unit receives the  
25 request.

3. The group judgment device of Claim 2,

wherein the target time obtaining unit includes:

5 a transmission/reception subunit operable to transmit  
first data with a predetermined format to the target device  
and receive, from the target device, second data with a  
predetermined format transmitted in response to the first  
data; and

10 a measurement subunit operable to measure, as the target  
time, a time required between (a) transmission of the first  
data by the transmission/reception subunit and (b) reception  
of the second data by the transmission/reception subunit.

4. The group judgment device of Claim 3,

15 wherein the transmission/reception subunit transmits  
to the target device, as the first data, echo-request data  
based on the Internet Control Message Protocol, and receives  
from the target device, as the second data, echo-reply data  
corresponding to the echo-request data.

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5. The group judgment device of Claim 2,

wherein time synchronization is achieved with the target  
device, and

the target time obtaining unit includes:

25 a time determining subunit operable to determine a

transmission-start time at which transmission of the data with the predetermined format is to be started;

a time notifying subunit operable to notify the target device of the transmission-start time determined by the time  
5 determining subunit;

a reception subunit operable to receive the data with the predetermined format that the target device transmits at the transmission-start time; and

a calculation subunit operable to calculate, as the  
10 target time, a time period between (a) a time at which the data with the predetermined format is received by the reception subunit and (b) the transmission-start time determined by the time determining subunit.

15 6. The group judgment device of Claim 2,  
wherein the target device measures the target time and transmits target time information indicating the target time, and

the target time obtaining unit receives the target time  
20 information from the target device.

7. The group judgment device of Claim 2, further comprising

a pre-storing unit operable to store therein a  
25 predetermined number of values of the target time,

wherein the target time obtaining unit employs, as the target time to be used for the comparison by the judgment unit, a smallest value, among the values stored in the pre-storing unit and a value of the obtained target time.

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8. The group judgment device of Claim 2,

wherein the judgment unit stores therein a value set in advance as the reference time.

10 9. The group judgment device of Claim 8, further comprising

a change receiving unit operable to receive a new value of the reference time from an external source,

wherein the judgment unit replaces the value stored as  
15 the reference time in the judgment unit with the new value received by the change receiving unit.

10. The group judgment device of Claim 2,

wherein the judgment unit includes:

20 a reference time storing subunit operable to store therein a value of the reference time set respectively for a connecting medium via which the target device is connected to the network;

a reception subunit operable to receive, from the target  
25 device, medium information indicating the connecting medium

via which the target device is connected to the network; and

5 a selection subunit operable to select, as the reference time, the value stored in the reference time storing subunit, based on the medium information received by the reception subunit.

11. The group judgment device of Claim 10, further comprising

10 a change receiving unit operable to receive a new value of the reference time from an external source,

wherein the reference time storing subunit replaces a value stored therein as the reference time, with the new value received by the change receiving unit.

15 12. The group judgment device of Claim 2,

wherein the judgment unit includes:

20 a reference time storing subunit operable to store a value of the reference time set for a combination of (a) a first connecting medium via which the group judgment device is connected to the network and (b) a second connecting medium via which the target device is connected to the network;

a medium detecting subunit operable to detect the first connecting medium;

25 a reception subunit operable to receive, from the target device, medium information indicating the second connecting

medium; and

a selection subunit operable to select, as the reference time, the value stored in the reference time storing subunit, based on the combination of (c) the first connecting medium detected by the medium detecting unit and (d) the second connecting medium indicated by the medium information received by the reception subunit.

13. The group judgment device of Claim 12, further comprising

a change receiving unit operable to receive a new value of the reference time from an external source,

wherein the reference time storing subunit replaces a value stored therein as the reference time, with the new value received by the change receiving unit.

14. The group judgment device of Claim 2,

wherein the judgment unit includes:

a transmission/reception subunit operable to transmit first data with a predetermined format to a router nearest to the group judgment device in the network, and receive, from the router, second data with a predetermined format transmitted in response to the first data; and

a measurement subunit operable to measure, as the reference time, a time required between (a) transmission of

the first data by the transmission/reception subunit and (b) reception of the second data by the transmission/reception subunit.

5           15. The group judgment device of Claim 14,  
            wherein the transmission/reception subunit transmits  
            to the router, as the first data, echo-request data based  
            on the Internet Control Message Protocol, and receives from  
            the router, as the second data, echo-reply data corresponding  
10     to the echo-request data.

            16. The group judgment device of Claim 14, further  
            comprising  
            a pre-storing unit operable to store therein a  
15     predetermined number of values of the reference time,  
            wherein the judgment unit employs, as the reference time  
            to be used for the comparison, a smallest value, among the  
            values stored in the pre-storing unit and a value of the  
            measured reference time.

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            17. The group judgment device of Claim 2,  
            wherein the group judgment device is connected to a  
            reference device via one router, the reference device having  
            been judged to belong to the group, and  
25     the judgment unit includes:

a transmission/reception subunit operable to transmit first data with a predetermined format to the reference device and receive, from the reference device, second data with a predetermined format transmitted in response to the first data; and

a measurement subunit operable to measure, as the reference time, a time required between (a) transmission of the first data by the transmission/reception subunit and (b) reception of the second data by the transmission/reception subunit.

18. The group judgment device of Claim 17, wherein the transmission/reception subunit transmits to the reference device, as the first data, echo-request data based on the Internet Control Message Protocol, and receives from the reference device, as the second data, echo-reply data corresponding to the echo-request data.

19. The group judgment device of Claim 17, further comprising

a pre-storing unit operable to store therein a predetermined number of values of the reference time,

wherein the judgment unit employs, as the reference time to be used for the comparison, a smallest value, among the values stored in the pre-storing unit and a value of the



measured reference time.

20. The group judgment device of Claim 2,

5 wherein the judgment unit judges that the target device belongs to the group when the target time is equal to or shorter than the reference time, and judges that the target device is external to the group when the target time is not equal to or shorter than the reference time.

10 21. The group judgment device of Claim 2,

wherein the group judgment device is connected to the target device via one router or via a plurality of routers, and

15 the judgment unit judges that the target device belongs to the group when the difference is shorter than a time required by the data with the predetermined format to travel via one router, and judges that the target device is external to the group when the difference is not shorter than the time required by the data with the predetermined format to travel via one  
20 router.

22. A group judgment device that is connected to a network and that shares common private information with a target device connected to the network, comprising:

25 a conversion unit operable to subject the private

information to predetermined conversion, to generate first conversion information;

5 a transmission/reception unit operable to transmit first data with a predetermined format to the target device, and receive, from the target device, second data with a predetermined format transmitted in response to the first data, the second data including second conversion information that has been generated by the target device subjecting the private information to the predetermined conversion;

10 a measurement unit operable to measure, as a target time, a time required between (a) transmission of the first data by the transmission/reception unit and (b) reception of the second data by the transmission/reception unit; and

a judgment unit operable to

15 (i) compare the target time measured by the measurement unit with a reference time, the reference time being a time required by data with a predetermined format to travel to and from a device belonging to a predetermined group, and (ii) compare the first conversion information generated by the conversion unit and the second conversion information  
20 included in the second data received by the transmission/reception unit, and

judge that the target device belongs to the group in an affirmative case where (i) a difference between the target  
25 time and the reference time is within a predetermined range

and (ii) the first conversion information and the second conversion information match, and judge that the target device is external to the group in any case other than the affirmative case.

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23. A group judgment device that is connected to a network and that shares common private information with a target device connected to the network, comprising:

10 a conversion unit operable to subject the private information to first conversion to generate first conversion information, and subject the private information to second conversion that is different from the first conversion, to generate second conversion information;

15 a transmission/reception unit operable to transmit first data with a predetermined format including the first conversion information to the target device, and receive, from the target device, second data with a predetermined format transmitted in response to the first data, the second data including third conversion information that has been  
20 generated by the target device subjecting the private information to the second conversion;

a measurement unit operable to measure, as a target time, a time required between (a) transmission of the first data by the transmission/reception unit and (b) reception of the  
25 second data by the transmission/reception unit; and

a judgment unit operable to

(i) compare the target time measured by the measurement unit with a reference time, the reference time being a time required by data with a predetermined format to travel to and from a device belonging to a predetermined group, and  
5 (ii) compare the second conversion information generated by the conversion unit and the third conversion information included in the second data received by the transmission/reception unit, and (iii) judge whether a  
10 message indicating that fourth conversion information and the first conversion information match has been received from the target device, the fourth conversion information having been generated by the target device subjecting the private information to the first conversion, and

15 judge that the target device belongs to the group in an affirmative case where (i) a difference between the target time and the reference time is within a predetermined range, (ii) the second conversion information and the third conversion information match, and (iii) the message has been  
20 received, and judge that the target device is external to the group in any case other than the affirmative case.

24. A target device that is connected to a network and that shares common private information with a group judgment  
25 device connected to the network, the target device being judged

by the group judgment device as to whether or not to belong to a predetermined group, the target device comprising:

a reception unit operable to receive first data with a predetermined format from the group judgment device;

5 a conversion unit operable to subject the private information to predetermined conversion, to generate first conversion information, before the reception unit receives the first data; and

a transmission unit operable to transmit second data  
10 with a predetermined format including the first conversion information to the group judgment device, when the reception unit receives the first data.

25. A target device that is connected to a network and  
15 that shares common private information with a group judgment device connected to the network, the target device being judged by the group judgment device as to whether or not to belong to a predetermined group, the target device comprising:

a reception unit operable to receive first data with  
20 a predetermined format including first conversion information from the group judgment device, the first conversion information having been generated by the group judgment device subjecting the private information to first conversion;

a conversion unit operable to subject the private  
25 information to second conversion that is different from the

first conversion, to generate second conversion information,  
before the reception unit receives the first data;

a transmission unit operable to transmit second data  
with a predetermined format including the second conversion  
5 information to the group judgment device, when the reception  
unit receives the first data;

a comparison unit operable to compare the first  
conversion information included in the first data received  
by the reception unit with third conversion information that  
10 has been generated by subjecting the private information to  
the first conversion; and

a notification unit operable to notify the group judgment  
device of a result of the comparison by the comparison unit.

15 26. A group judgment system including a target device  
and a group judgment device that are connected to a network,  
the target device and the group judgment device sharing common  
private information in advance,

wherein the target device includes:

20 a reception unit operable to receive first data with  
a predetermined format from the group judgment device;

a first conversion unit operable to subject the private  
information to predetermined conversion, to generate first  
conversion information, before the reception unit receives  
25 the first data; and

a transmission unit operable to transmit second data with a predetermined format including the first conversion information to the group judgment device, when the reception unit receives the first data, and

5 the group judgment device includes:

a transmission/reception unit operable to transmit the first data to the target device, and receive the second data including the first conversion information;

10 a measurement unit operable to measure, as a target time, a time required between (a) transmission of the first data by the transmission/reception unit and (b) reception of the second data by the transmission/reception unit;

15 a second conversion unit operable to subject the private information to the predetermined conversion, to generate second conversion information; and

a judgment unit operable to

20 (i) compare the target time measured by the measurement unit with a reference time, the reference time being a time required by data with a predetermined format to travel to and from a device belonging to a predetermined group, and (ii) compare the second conversion information generated by the second conversion unit and the first conversion information included in the second data received by the transmission/reception unit, and

25 judge that the target device belongs to the group in

an affirmative case where (i) a difference between the target time and the reference time is within a predetermined range and (ii) the second conversion information and the first conversion information match, and judge that the target device is external to the group in any case other than the affirmative case.

27. A group judgment system including a target device and a group judgment device that are connected to a network, the target device and the group judgment device sharing common private information in advance,

wherein the target device includes:

a reception unit operable to receive first data with a predetermined format including first conversion information from the group judgment device;

a first conversion unit operable to subject the private information to first conversion, to generate second conversion information, before the reception unit receives the first data;

a transmission unit operable to transmit second data with a predetermined format including the second conversion information to the group judgment device, when the reception unit receives the first data;

a comparison unit operable to compare third conversion information and the first conversion information, the third



conversion information having been generated by subjecting the private information to second conversion that is different from the first conversion; and

5 a notification unit operable to notify the group judgment device of a result of the comparison by the comparison unit, and

the group judgment device includes:

10 a second conversion unit operable to subject the private information to the second conversion, to generate the first conversion information, and subject the private information to the first conversion, to generate fourth conversion information;

15 a transmission/reception unit operable to transmit the first data including the first conversion information to the target device, and receive the second data including the second conversion information from the target device;

20 a measurement unit operable to measure, as a target time, a time required between (a) transmission of the first data by the transmission/reception unit and (b) reception of the second data by the transmission/reception unit; and

a judgment unit operable to

25 (i) compare the target time measured by the measurement unit with a reference time, the reference time being a time required by data with a predetermined format to travel to and from a device belonging to a predetermined group, and

(ii) compare the fourth conversion information generated by the second conversion unit and the second conversion information included in the second data received by the transmission/reception unit, and (iii) check the result of the comparison received from the target device indicating whether the first conversion information and the third conversion information match, and

judge that the target device belongs to the group in an affirmative case where (i) a difference between the target time and the reference time is within a predetermined range, (ii) the fourth conversion information and the second conversion information match, and (iii) the result indicates that the first conversion information and the third conversion information match, and judge that the target device is external to the group in any case other than the affirmative case.

28. A group judgment method that is used by a group judgment device connected to a network, comprising:

a target time obtaining step of obtaining, as a target time, a time required by data with a predetermined format to travel to and/or from a target device connected to the network; and

a judgment step of comparing the target time with a reference time, the reference time being a time required by data with the predetermined format to travel to and/or from

a device belonging to a predetermined group, and judging that the target device belongs to the group when a difference between the target time and the reference time is within a predetermined range, and judging that the target device is external to the group when the difference is not within the predetermined range.

29. A group judgment program that is implemented by a computer connected to a network, comprising:

10 a target time obtaining step of obtaining, as a target time, a time required by data with a predetermined format to travel to and/or from a target device connected to the network; and

a judgment step of comparing the target time with a reference time, the reference time being a time required by data with the predetermined format to travel to and/or from a device belonging to a predetermined group, and judging that the target device belongs to the group when a difference between the target time and the reference time is within a predetermined range, and judging that the target device is external to the group when the difference is not within the predetermined range.

30. A storage medium storing a group judgment program that is implemented by a computer connected to a network,

the group judgment program comprising:

5 a target time obtaining step of obtaining, as a target time, a time required by data with a predetermined format to travel to and/or from a target device connected to the network; and

10 a judgment step of comparing the target time with a reference time, the reference time being a time required by data with the predetermined format to travel to and/or from a device belonging to a predetermined group, and judging that the target device belongs to the group when a difference between the target time and the reference time is within a predetermined range, and judging that the target device is external to the group when the difference is not within the predetermined range.

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